

# PATENT ABSTRACTS OF JAPAN

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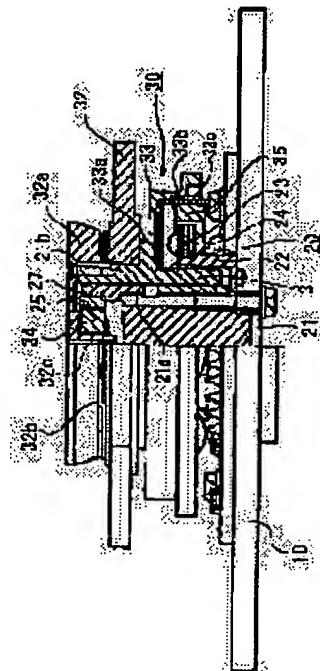
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## (54) GAS DYNAMIC PRESSURE BEARING DEVICE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To manufacture a dynamic pressure bearing device of high performance in which the dynamic pressure surface equipped with precise dimensions is established efficiently.

**SOLUTION:** At least one of a stationary member 21 and rotary member 31 having dynamic pressure surface is made from powder metallurgical molding using a powder metal material of aluminum, and thereby a high dimensional accuracy can be obtained directly without any post-processing such as machining, and also excellent anti-abrasiveness and lubricating performance are obtained through the action of additives.



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## CLAIMS

[Claim 1] While being arranged pivotable, a rotation member carrying out field opposite to a holddown member A dynamic pressure side is formed in both the opposed faces of the above-mentioned holddown member and a rotation member, respectively. According to an operation of the dynamic pressure generating means of both [ these ] the opposite dynamic pressure sides formed in one side at least In the gas hydrodynamic bearing equipment which the gas which intervened in the bearing clearance between both the above-mentioned opposite dynamic pressure sides is made to generate dynamic pressure, and supported the rotation member pivotable to said holddown member The holddown member in which the above-mentioned dynamic pressure side was formed, and a rotation member at least the member of one side While consisting of powder metallurgy Plastic solids of the fine-particles ingredient which mixed wear-resistant and lubricative add-in material to the powder metal base material containing an aluminium powder, the above-mentioned powder metallurgy Plastic solid Gas hydrodynamic bearing equipment characterized by being formed in the condition of having exposed said add-in material on the front face of the dynamic pressure side concerned so that the abrasion resistance and lubricity of said dynamic pressure side may be raised.

[Claim 2] It is gas hydrodynamic bearing equipment according to claim 1 characterized by said wear-resistant and lubricative add-in material being a thing containing at least one of a graphite, SiC and aluminum<sub>2</sub>O<sub>3</sub>, and Si<sub>3</sub>N<sub>4</sub> while the powder metal base material which consists of said aluminum material contains aluminum-Si system powder.

[Claim 3] Gas hydrodynamic bearing equipment according to claim 1 characterized by mixing said wear-resistant add-in material by 0.1 thru/or 10% of the weight of within the limits.

[Claim 4] Gas hydrodynamic bearing equipment according to claim 1 characterized by

attaching the mirror object for light scanning in this rotation member while the rotation member is constituted by said powder metallurgy Plastic solid.

## DETAILED DESCRIPTION

### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention] This invention relates to the gas hydrodynamic bearing equipment which supported the above-mentioned rotation member pivotable by making the gas made to intervene between the dynamic pressure side by the side of a holddown member, and the dynamic pressure side by the side of a rotation member generate dynamic pressure.

#### [0002]

[Description of the Prior Art] Gas hydrodynamic bearing equipment is being widely adopted as the driving gear which carries out high-speed rotation of the various body of revolution, such as a polygon mirror, a magnetic disk, and an optical disk, in recent years. For example, it sets to the hydrodynamic bearing equipment used for the motor for a polygon mirror drive which applied the invention in this application like drawing 2 . The dynamic pressure side established in the peripheral face of the fixed shaft 21 which constitutes the stator 20 as a holddown member, The dynamic pressure side of the bearing sleeve 31 which constitutes Rota 30 as a rotation member The air which is arranged so that field opposite may be carried out through a narrow clearance radial, and intervened as a lubrication fluid in the bearing clearance between both [ these ] opposite dynamic pressure sides It is pressurized by pumping operation of the dynamic pressure generating manual stage of both the above-mentioned opposite

dynamic pressure sides (illustration abbreviation) formed in one side at least. Based on the air dynamic pressure which this generated, rotation support of above-mentioned whole Rota 30 is carried out to a stator 20 side in a radial direction.

[0003] Since high abrasion resistance is required, what performed surface treatment which raises abrasion resistance on the surface of a metallic material as the above-mentioned fixed shaft (shank material) 21 and a bearing sleeve (bearing member) 31 is often used, and in such a dynamic pressure side of gas hydrodynamic bearing equipment, he raises abrasion resistance and lubricity, and is trying to prevent generating, such as printing, by performing such surface treatment to it. As the surface preparation, although there is each means, such as vacuum evaporationo of plating, a resin coat, and an inorganic material or coating, more specifically in JP,9-88941,A and JP,10-103343,A, a resin coat layer and the ceramic vacuum evaporationo film are formed to the front face of a metallic material, respectively. Moreover, the inorganic coat by the metal alkoxide is given to the coat layer in the thing given in JP,5-44055,A. The proposal which formed either or the both sides of shank material and a bearing member with the ceramic ingredient is also made further again.

#### [0004]

[Problem(s) to be Solved by the Invention] However, such gas hydrodynamic bearing equipment needs to perform post processing by cutting highly precise after surface treatment etc. in what performed surface treatment from it being necessary to set up and maintain the path clearance of the bearing clearance between dynamic pressure sides at about [ 6micrometer\*\*1micrometer ] high degree of accuracy to a metallic material which was mentioned above.

Consequently, a fall and cost quantity of productivity are invited. on the other hand, a ceramic ingredient is used -- as -- the bottom -- if -- since processing was difficult, it was hard to take out dimensional accuracy, and the much more cost quantity and the much more productivity slowdown are invited from expensive tools, such as a diamond wheel, being used.

[0005] Then, this invention aims at offering the gas hydrodynamic bearing equipment which enabled it to acquire cheaply the dynamic pressure side equipped with the highly precise dimension.

[0006]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, while being arranged pivotable, a rotation member carrying out field opposite to a holddown member with gas hydrodynamic bearing equipment according to claim 1 A dynamic pressure side is formed in both the opposed faces of the above-mentioned holddown member and a rotation member, respectively. According to an operation of the dynamic pressure generating means of both [these] the opposite dynamic pressure sides formed in one side at least In the gas hydrodynamic bearing equipment which the gas which intervened in the bearing clearance between both the above-mentioned opposite dynamic pressure sides is made to generate dynamic pressure, and supported the rotation member pivotable to said holddown member The holddown member in which the above-mentioned dynamic pressure side was formed, and a rotation member at least the member of one side While consisting of powder metallurgy Plastic solids of the fine-particles ingredient which mixed wear-resistant and lubricative add-in material to the powder metal base material containing an aluminium powder, the above-mentioned powder metallurgy Plastic solid It is formed in the condition of

having exposed said add-in material on the front face of the dynamic pressure side concerned so that the abrasion resistance and lubricity of said dynamic pressure side may be raised.

[0007] Moreover, with gas hydrodynamic bearing equipment according to claim 2, while the powder metal base material which consists of said aluminum material according to claim 1 contains aluminum-Si system powder, said wear-resistant and lubricative add-in material contains at least one of a graphite, SiC and aluminum<sub>2</sub>O<sub>3</sub>, and Si<sub>3</sub>N<sub>4</sub>.

[0008] Furthermore, with gas hydrodynamic bearing equipment according to claim 3, said wear-resistant add-in material according to claim 2 is mixed by 0.1 thru/or 10% of the weight of within the limits.

[0009] With gas hydrodynamic bearing equipment according to claim 4, while the rotation member is constituted by said powder metallurgy Plastic solid according to claim 1, the mirror object for light scanning is attached in this rotation member further again.

[0010] Since the member which has a dynamic pressure side consists of powder metallurgy Plastic solids using the powder metal material of aluminum material, while close dimensional accuracy is obtained immediately according to the gas hydrodynamic bearing equipment concerning this invention which has such a configuration, without performing post processing, the dynamic pressure side which has the abrasion resistance and lubricity which were excellent with an operation of add-in material is acquired easily.

[0011] Moreover, when this invention is applied to the rotation member which carries out the rotation drive of the mirror object for light scanning, since the base section of the above-mentioned mirror object usually consists of aluminum

material, a part for the joint of a rotation member and a mirror object consists of same ingredients, and good junction relation is obtained.

[0012]

[Embodiment of the Invention] Hereafter, although the gestalt of operation of this invention is explained, the operation gestalt of this invention is described, explaining the structure of the motor for a polygon mirror drive of the axial cover half equipped with the air hydrodynamic bearing which applied this invention based on a drawing.

[0013] The motor for a polygon mirror rotation drive shown in drawing 2 is an example of the outer rotor mold motor equipped with the air hydrodynamic bearing equipment of an axial cover half, and consists of a stator group 20 as a holddown member attached to the frame 10 side, and a Rota group 30 as a rotation member attached from the illustration bottom to this stator group 20 as inserted in. Among these, the stator group 20 as a holddown member is formed so that a fixed distance may be separated from the peripheral face of the fixed shaft 21 to radial and the cylinder-like core electrode holder 22 may enclose the above-mentioned fixed shaft 21, while having the fixed shaft (shank material) 21 attached so that it might set up to the abbreviation center position of the above-mentioned frame 10. And while the stator core 23 is attached in the periphery of the above-mentioned core electrode holder 22, the drive coil 24 is respectively wound to the part corresponding to each salient pole section of the stator core 23.

[0014] The part used as the base of the above-mentioned fixed shaft 21 is formed from aluminum material, such as aluminum and an aluminium alloy, and the lubricative resin coat is formed in the periphery front face including the dynamic

pressure bearing surface of the fixed shaft 21 of electropainting, various kinds of surface treatment, etc. Moreover, the groove is cut so that the slot for dynamic pressure generating of a herringbone mold (illustration abbreviation) may divide into shaft orientations at 2 blocks and may stand in a row annularly, and in the outside of the fixed shaft 21 in which the slot for dynamic pressure generating concerned was established, a several micrometers - about ten micrometers clearance is separated, and the peripheral face of the above-mentioned fixed shaft 21 is equipped with the bearing sleeve (bearing member) 31 of said Rota group 30 pivotable on it.

[0015] To the dynamic pressure side formed in the periphery side-attachment-wall side of the fixed shaft 21 mentioned above, radial is equipped with the dynamic pressure side which the bearing sleeve 31 as the above-mentioned bearing member formed the powder metallurgy Plastic solid of aluminum material in the abbreviation bell shape, and was formed in the inner circumference side-attachment-wall side so that field opposite may be carried out. The powder metallurgy Plastic solid which constitutes this bearing sleeve 31 is fabricated using the fine-particles ingredient which mixed the add-in material for raising abrasion resistance and lubricity to it by using powder metal containing aluminium powders, such as aluminum-Si system powder, and aluminum-Si-nickel system powder or aluminum-Si-Fe system powder, as a base material.

[0016] What used as quenching powder the raw material of aluminum-Si which contains Si to about 20% of the weight as the above-mentioned powder metal base material with gas atomization equipment 1 as shown in drawing 1 (a), for example is used. The add-in material which contains at least one of a graphite,

Sic and aluminum203, and Si3Ns4 in this above-mentioned quenching powder with and the blender 2 as shown at drawing 1 (b) It mixes by 0.1 thru/or 10% of the weight of within the limits, and fabricates to the billet for hot extrusion, or preforming for plastic forging using the mixed powder (\*\*\*\*) which this obtained with the metal mold molding press which omitted the hydrostatic-pressure molding press (CIP) 3 or illustration as shown in drawing 1 (c). Subsequently, by performing hot extrusion or powder forging, as it is shown in drawing 1 (d), producing the round bar material of true density without pore, and machining the round bar material (cutting) On the front face of the dynamic pressure side of the bearing sleeve (bearing member) 31 which was mentioned above, it forms so that the add-in material mentioned above may be exposed, and he is trying to obtain the bearing sleeve (bearing member) 31 which raised abrasion resistance and lubricity with a highly precise dimension.

[0017] It returns to drawing 2 and the flat-surface hexagon-like polygon mirror 32 is attached in the periphery of the illustration upper part of the bearing sleeve 31 which carried out in this way and was obtained. This polygon mirror 32 is laid on maintenance plate 33a equivalent to the pars basilaris ossis occipitalis of the Rota drum section 33 which uses aluminum material for the base section and extends toward the method of the outside of radial from said bearing sleeve 31, and when a part for the core on the top face of illustration of the polygon mirror 32 concerned is bound tight through presser-bar-spring 32b by clamp member 32a with which the above-mentioned bearing sleeve 31 was equipped from a shaft-orientations outside, it has fixed.

[0018] It is annularly formed in a part for the point of the above-mentioned fixed shaft 21 (illustration upper limit part) further again so that periphery wall 21b

may carry out a specified quantity protrusion at shaft orientations (the direction of the illustration upper part), and the inner circumference side of the protrusion periphery wall 21b is annularly equipped with the fixed side thrust magnet 25 for thrust surfacing. Magnetization of shaft orientations (the illustration vertical direction) is given to this fixed side thrust magnet 25.

[0019] The Rota drum section 33 mentioned above consists of an approximately cylindrical member formed in said bearing sleeve 31 and one, and it is arranged so that the space in Rota where said drive coil 24 has been arranged, and the space outside Rota where the polygon mirror 32 has been arranged may be divided. The inner circle wall side of tubed tie-down plate 33b established in the periphery edge of this Rota drum section 33 is annularly equipped with the drive magnet 35 through back yoke 33c which consists of magnetic material. The above-mentioned drive magnet 35 is arranged so that the motorised section may be constituted, and contiguity opposite may be carried out from the method of the outside of radial to each salient pole section of the stator core 23 mentioned above.

[0020] And if predetermined driver voltage is impressed to the above-mentioned drive coil 24, the polygon mirror 32 rotates with a bearing sleeve 31, and the image recording medium top by which the laser light which it converged on this polygon mirror 32 by rotation of this polygon mirror 32 is not illustrated is scanned. Moreover, while being supported by the dynamic pressure of the air which generates a bearing sleeve 31 between bearing sleeves 31 and the fixed shafts 21 concerned at this time in a radial direction, it is held at the condition that specified quantity surfacing of the whole Rota group 30 was carried out by the mutual magnetic action of the rotation side thrust magnet 34 and the fixed

side thrust magnet 25 in the thrust direction to the stator group 20.

[0021] Since the bearing sleeve 31 which has a dynamic pressure side consists of powder metallurgy Plastic solids using the powder metal material containing an aluminium powder, while close dimensional accuracy is immediately obtained without post processing, such as cutting, according to the gas hydrodynamic bearing equipment concerning this operation gestalt which has the above configuration, the abrasion resistance and lubricity which were excellent with an operation of add-in material are obtained easily.

[0022] Moreover, with this operation gestalt, since this invention is applied to the bearing sleeve 31 which carries out the rotation drive of the polygon mirror 32 for light scanning and the base section of the above-mentioned polygon mirror 32 consists of aluminum material, it is made by the configuration that a part for the joint of a bearing sleeve 31 and the polygon mirror 32 is constituted by the same ingredient, consequently good junction relation is obtained.

[0023] As mentioned above, although the operation gestalt of invention made by this invention person was explained concretely, it cannot be variously overemphasized in the range which this invention is not limited to the above-mentioned operation gestalt, and does not deviate from the summary that it is deformable.

[0024] For example, although the above-mentioned operation gestalt applies this invention to a bearing member (bearing sleeve), applying similarly to shank material is also possible. Moreover, even if a bearing member or shank material is the case where any of a holddown member or a rotation member are constituted, this invention is applicable similarly.

[0025] Furthermore, this invention is applicable similarly to gas hydrodynamic

bearing equipments for a hard disk drive (HDD) other than the gas hydrodynamic bearing equipment for the polygon mirror rotation mentioned above etc.

[0026]

[Effect of the Invention] The gas hydrodynamic bearing equipment applied to this invention as stated above By constituting from a powder metallurgy Plastic solid using the powder metal material of the holddown member which has a dynamic pressure side, or a rotation member which contains an aluminium powder for the member of one side at least Since the abrasion resistance and lubricity which were excellent with an operation of add-in material are easily obtained while obtaining close dimensional accuracy without post processing, such as cutting, immediately It becomes possible to manufacture efficiently the dynamic pressure side equipped with the highly precise dimension, and highly efficient gas hydrodynamic bearing equipment can be obtained cheaply.

[0027] Moreover, when a part for the joint of a bearing member and a mirror object is constituted from same ingredient and good junction relation is obtained by applying this invention to the rotation member which attaches the mirror object for light scanning, in addition to the effectiveness mentioned above, the dependability of a polygon mirror driving gear can be raised.

#### DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is an appearance strabism explanatory view showing the outline process which manufactures the powder metallurgy Plastic solid concerning 1 operation gestalt of this invention.

[Drawing 2] It is a longitudinal-section explanatory view showing an example of the motor for a polygon mirror drive which has gas hydrodynamic bearing equipment concerning 1 operation gestalt of this invention.

[Description of Notations]

20 Stator Group

21 Fixed Shaft (Shank Material)

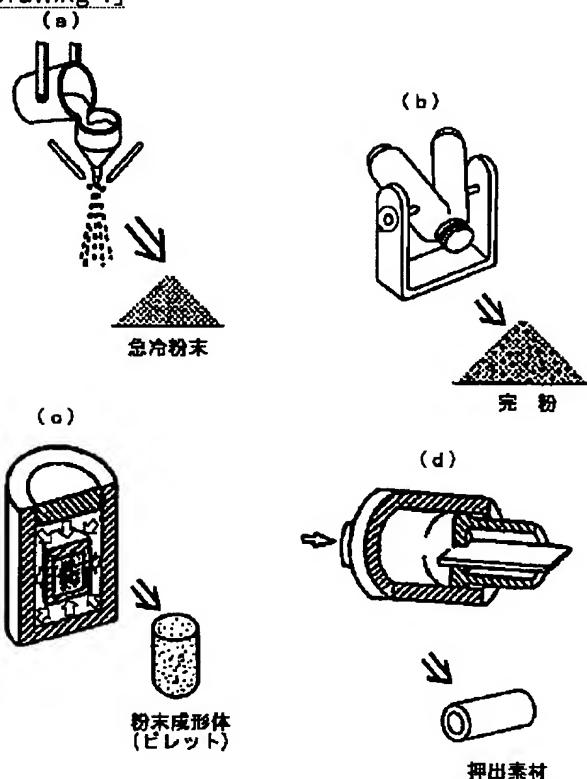
30 Rota Group

31 Bearing Sleeve (Bearing Member)

32 Polygon Mirror

## DRAWINGS

## [Drawing 1]



## [Drawing 2]

